



**Washington State Higher Education Coordinating Board
Resolution Number 06-11
2006-2007 High-Demand Enrollment Grant**

Institution:

Western Washington University

Program:

Plastics Engineering Technology Vehicle Design Option

Budget Amount¹:

\$115,510

FTE:

10

Proposal History²:

The original proposal was dated 5-2-06.

The budget was amended by Western Washington University on 5-12-06.

The proposal text was revised by Western Washington University on 5-26-06.

The budget was updated by Higher Education Coordinating Board to include explanatory footnotes on 6-16-06.

Notes:

1. The budget amount reflects changes resulting from the review process.
2. The proposal text, budget and unsigned proposal cover sheet posted here on the HECB Web site reflect all amendments, revisions and updates, but the signed proposal cover sheet does not. It is the cover sheet submitted with the original proposal.

WESTERN WASHINGTON UNIVERSITY
2006-07 High Demand Enrollment Request

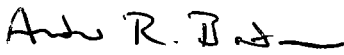
A Proposal to Expand Enrollment in Plastics Engineering Technology Through Creation of a Vehicle Design Option at Western Washington University

A response to the HECB April 6, 2006, Request for Proposals: "Expansion of Enrollment Opportunities in High-Demand Fields" for FY 2006-07

Number of FTE Enrollments Requested: 10.00 FTE

@\$15,276 per FTE

Total Grant Funding Requesting for FY 2006-07: \$152,760



Andrew R. Bodman, Provost and
Vice President of Academic Affairs

 5-2-06

Paula M. Rustan, Executive Director,
University Planning and Budgeting

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Expansion of Enrollment Opportunities in High Demand Fields: Plastics Engineering Technology Vehicle Design Option

Introduction

Both the accredited Plastics Engineering Technology (PET) and the Industrial Technology-Vehicle Design (IT-VD) programs at **Western Washington University** have been growing rapidly over the last four to six years. While some enrollment capacity remains within the accredited PET program, the IT-VD program is at capacity due primarily to student demand.

The proposed project involves accommodating a total of 10 additional student FTE enrollments in a new Plastics Engineering Technology–Vehicle Design option with an emphasis on composite materials.

The growing popularity of vehicle design ensures demand by students, while unmet employer demand for PET graduates, especially in composites-related industries within Washington State, ensures a market for graduates of the new program. The proposed program will be configured to provide a strong background specifically for employment in the aerospace, marine, and truck manufacturing industries. Successful implementation of the new option will require one new faculty position and one FTE of technical staff support.

Program Description

We propose to create within the existing Plastics Engineering Technology (PET) program a new Vehicle Design (VD) option with an emphasis on design and manufacture using composite materials. Currently Western Washington University's PET program is one of only four baccalaureate PET programs in the nation accredited by the Technology Accreditation Commission of the Accrediting Board for Engineering and Technology, and the only such program west of the Mississippi River.

Western's current Industrial Technology – Vehicle Design (IT-VD) program is highly in demand by students but is not accredited, making it less desirable to many employers. By creating a new Vehicle Design option within the PET program we expect to increase the number of graduates in the accredited PET program while simultaneously accommodating more students interested in Vehicle Design than could be accommodated in the existing Industrial Technology-Vehicle Design program. The graduates of the newly created and accredited PET-VD program will be highly in demand by employers.

The existing Plastics Engineering Technology (PET) curriculum consists of the following courses:

ETEC 110	Engineering Design Graphics I
ETEC 111	Engineering Design Graphics II
ETEC 220	Introduction to Engineering Materials
ETEC 223	Machine Metal Processes
ETEC 224	Applied Engineering Statics
ETEC 225	Strength of Materials
ETEC 322	Numerical Control Operations
ETEC 333	Polymer Technology
ETEC 334	Reinforced Plastics/Composites
ETEC 335	Tooling for Plastics Processing
ETEC 337	Secondary Operations
<i>ETEC 338</i>	<i>Injection Molding</i>
ETEC 341	Engineering and Society
ETEC 344	Reinforced Plastics/Composites
ETEC 351	Electronics for Engineering Technology
ETEC 430	Plastics Senior Project - Definition
<i>ETEC 431</i>	<i>Plastics Product Design</i>
ETEC 432	Plastics Senior Project - Implementation
<i>ETEC 433</i>	<i>Engineering Polymers</i>
ETEC 434	Advanced Composites
<i>ETEC 436</i>	<i>Polymer Compounding</i>
ETEC 444	Data Analysis and Design of Experiments
MATH 115/118	Precalculus II / Accelerated Precalculus
MATH 124	Calculus and Analytic Geometry
MATH 125	Calculus and Analytic Geometry
MATH 240	Introduction to Statistics
PHYS 114	Principles of Physics I
PHYS 115	Principles of Physics II
CHEM 121	General Chemistry I
CHEM 251	Elementary Organic Chemistry
<i>CHEM 308</i>	<i>Introduction to Polymer Chemistry</i>
COMM 101	Fundamentals of Speech
CSCI 140	Programming Fundamentals

12 credits of technical electives.

In the proposed new Vehicle Design option in Plastics Engineering Technology, the courses shown above in *italics* would be eliminated and replaced with the following courses:

ETEC 280	Power Mechanics
ETEC 281	Power Transmission
ETEC 380	Advanced Power Mechanics
ETEC 480	Advanced Emission Control
ETEC 484	Vehicle Design
ETEC 486	Advanced Vehicle Design

2 credits of technical electives.

Students would have the option of either taking the standard curriculum, or the new Vehicle Design option. The vehicle design option is configured to provide a stronger background specifically for positions in the aerospace, marine, and truck manufacturing industries.

Project Development Schedule

2006-2007

Vehicle Design option in Plastics Engineering Technology created. A goal of ten FTE students will be admitted to the option by the end of the 2006-07 academic year.

One FTE technician will be hired to work half time in the plastics lab and half time in the Vehicle Design lab. This technician support will allow faculty to expand classes to accommodate the additional students.

An additional full-time tenure-track faculty person will be hired. The combination of additional technician support and additional faculty will allow new sections of courses critical to the new major option pathway to be offered, including additional sections of ETEC 322, Numerical Control Operations, and selected Vehicle Design courses.

Responsiveness to Economic Needs

According to the HECB's State and Regional Needs Assessment¹ current degree production only meets 67 percent of the need in engineering. In addition, engineering and technology are identified as fields of priority in House Bill 2817. Graduates of the PET program are well prepared for positions in the fields of engineering and technology. Furthermore, according to the Washington State Employment Situation Report for

¹ State and Regional Needs Assessment, Washington Higher Education Coordinating Board, October 2005, p. 28.

March² manufacturing jobs have increased by 10,600 in the past 12 months. Specific segments that have been hiring include aerospace products and parts, ship and boat building, and plastics product manufacturing. These are precisely the industries in which a majority of the graduates from Western's current PET program have historically been placed.

The unique character of the Plastics Engineering Technology program at WWU makes it likely that demand for its graduates will continue to be high in the foreseeable future. PET programs are rare, there being only four ABET accredited PET programs in the nation, and Western offers the only accredited program in the west. In addition, each program is unique, the precise curriculum being driven by the needs of local industry.

Western's program differs from others in its stronger emphasis on composite materials in support of the needs of the local aerospace, marine, truck manufacturing, and sporting goods industries. Boatbuilding has long used fiberglass composites extensively, and more recently has begun incorporating carbon fiber composites. The aerospace industry has also long used composites, but Boeing's new 787 will comprise 50% composite materials as compared to only 12% for the 777.³

The proposed new Vehicle Design option in Plastics Engineering Technology would give students the solid technical background currently provided by the existing PET program with an emphasis on vehicles and composites, making the graduates well-prepared for the aerospace, marine and truck manufacturing industries.

One of the key guiding principles of Engineering Technology is the maintenance of a close relationship with industry to ensure that students are well prepared for industrial positions upon graduation. Curriculum in the PET program is guided by an Industrial Advisory Committee consisting of employers from the region, including representatives of C&D Zodiac, Boeing, Hexcel, Nypro, R&D Plastics, Pacific Research Laboratories, Hewlett-Packard, Intel, Vaupell Industrial Plastics, and Pacific Injection Molding. In addition, students are required to complete a senior project, usually with an industrial sponsor. Recent senior project sponsors include PACCAR, C&D Zodiac, Pacific Research Laboratories and Vaupell.

Responsiveness to Desirable Attributes

Beneficial Partnerships:

Edmonds Community College: Western's PET program is actively partnered with Edmonds Community College's Materials Science Technology (MST) program. PET faculty were involved in the development of the MST curriculum and serve on its advisory committee. A formal articulation agreement is under development

² Washington State Employment Situation Report for March, Washington State Employment Security Department, Labor Market and Economic Analysis Branch, April 18, 2006. pp 2, 4.

³ Boeing 787 Dreamliner Fact Sheet, Boeing Commercial Airplane Company, February 2005.

to accept students directly into Western's PET program from EdCC's MST program, and 3 students of 6 in the MST program's first graduating class were accepted into the PET program under a draft agreement.

Snohomish High School: A PET faculty member serves on the advisory board for Snohomish High School's CAD/Precision Machining Advisory Committee, which is developing a composites manufacturing program at the high school level. It is expected that this program will lead to interest among students at SHS in entering Western's PET program to continue their study of composites.

Private-sector Businesses and Industry Associations: The PET program has an extensive array of partnerships with private-sector businesses and industry associations. Some of the partnerships include:

- In 2006 Negri Bossi has placed an injection molding machine in Western's PET lab. Negri Bossi retains ownership of the machine, but allows the use of it to teach students the fundamentals of plastic injection molding. Approximate value of this machine is \$85,000.
- In October 2005 PACCAR provided a grant to a PET faculty member to purchase a reaction injection molding machine to investigate molding conditions on surface oxidation. Grant amount was \$85,000.
- The Pacific Northwest Chapter of the Society of the Plastics Industry (SPI) meets annually on Western's campus in cooperation with the PET program. This relationship has led to numerous benefits to the PET program, including the Negri Bossi agreement mentioned above, scholarships for PET students sponsored by SPI (\$1,000 in 2005), and numerous in-kind donations of plastic materials.
- A variety of companies sponsor PET senior projects. Recent company sponsored projects are shown in Table 1 below:

Table 1: Recent Industry Sponsored Senior Projects	
Industrial Partner	Title
C & D Zodiac	Designed Experiment to Evaluate Insert Pull-out Strength in Laminates
Milgard	Fusion Characteristics of PVC formulations
Dri-Eaz	Redesign of a Composite Extraction Wand
OthoPets	Material Characterization for a Canine Knee Brace
Dri-Eaz	Depth Protimeter for Measuring Moisture in Wood at Various Depths
Paccar	Oxidation of a Thermoset Polyolefin: Examination by Scanning Electron Microscope
Paccar	Tooling for Reaction Injection Molding Process
Paccar	Implementation of a Reaction Injection Molding Machine Infrastructure
C & D Zodiac	Evaluation of composite materials for table leaves in Bombardier's global family of jets

Vaupell	Implementing fixtures for the BRITAX H3339-XXX seat row marker assembly
Artisan Industries	Formulation Effects Performance of Synthetic Wine Closure
Paccar	Measurement of Oxidation on PDCPD
Pacific Research	Composite Bones
ICE	Trapped Rubber Molding of a Composite Scope
Aerotech Sports	Expandable Foam Core Composites for Ski Design
Intel	Universal Communicator for Intel

Sources of Additional Funding: In-kind donations by private-sector partners this academic year are shown in Table 2 below:

Table 2: 2005-06 In-Kind Donations to the PET Program		
Company	Item	Estimated Value
Carlson Steel	Drive Train System	\$300
Fiberlay	Polyester Resin	\$500
General Plastics	Foam Core	\$500
Diab	Balsa Core	\$100
R&D Plastics	Thermoplastic Material	\$900
Nypro, Incorporated	Thermoplastic Material	\$1200
Mold Rite	Thermoplastic Material	\$2400
Upchurch Scientific	Thermoplastic Material	\$700
Upchurch Scientific	Hastelloy (metal for dies)	\$400
DME	Aluminum Mold Inserts and cutting tools	\$3300
Fluke	FDM 3000 (Fused Deposition Modeling Rapid Prototyping Machine)	\$25000 (to entire ET dept)
Janicki Industries	Carbon Fiber	\$30000
Boeing	Surplus Materials	\$25000 (to entire ET dept)

Opportunities for Students to Gain Work Experience: Because of the network of industry partners most PET students have an opportunity to obtain an internship directly relevant to their field for one or more summers during their career at Western. Companies that hired interns during summer 2005 include: Vaupell Industrial Plastics, Northwest Composites (now C&D Zodiac), R&D Plastics, Nypro, Janicki Industries, Eddyline Kayaks, and Hexcel. Companies that have requested interns for summer 2006 include: Nike, Hexcel, LOUD Technologies, C&D Zodiac, Jeld-Wen, and Inject Tool & Die.

Demonstration of Student Demand

Figure 1 shows the number of majors in the PET program by academic year from 90/91 to present. Enrollments in the PET program grew rapidly from 93/94, when the program first converted from Industrial Technology to Engineering Technology, through 98/99. There was then a period of contraction ending in 02/03, largely coincident with a decline in industry demand caused by offshoring and economic contraction. This decline is consistent with declining enrollments during that period reported by faculty at other schools offering PET programs. However, since 02/03 enrollments have grown rapidly with the total declared majors in spring 2006 being 52, the highest total ever. Furthermore, given the employer demand described below, there is further reason to expect the student demand to increase.

It is more difficult to quantitatively demonstrate student demand in the current Industrial Technology – Vehicle Design program, since data on the number of majors in Industrial Technology broken out by program is available only for the 05/06 academic year. There are multiple programs within Industrial Technology and prior to 05/06, all IT majors were reported together. However, demand may be gauged by looking at the enrollment in key courses. Figure 2 shows enrollment in two courses, ETEC 281, one of the early courses taken exclusively by Vehicle Design majors, and ETEC 486, one of the senior level courses taken exclusively by Vehicle Design majors.

The chart clearly shows that starting in 2001 there was a rapid increase in demand for the IT – Vehicle Design program, as demonstrated by the increasing enrollment in ETEC 281. Currently there are insufficient sections of the senior level courses to accommodate all students taking ETEC 281. The 36 students taking ETEC 486 in 05/06 represented a significant oversubscription to that class, and that number is not sustainable with current resources. However, the demand will continue to grow to nearly equal the number of students taking ETEC 281. Existing resources in the Vehicle Design program are sufficient to accommodate approximately 24 graduates per year. Without additional resources the enrollment will need to be capped at that level.

Figure 1: Total PET Majors by Academic Year

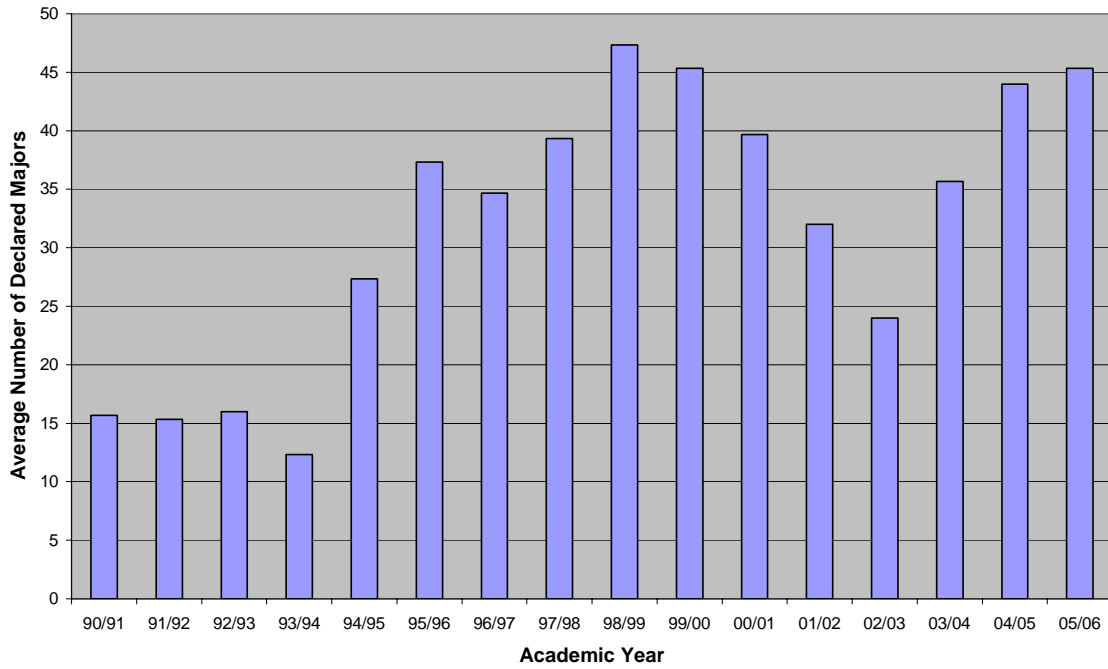
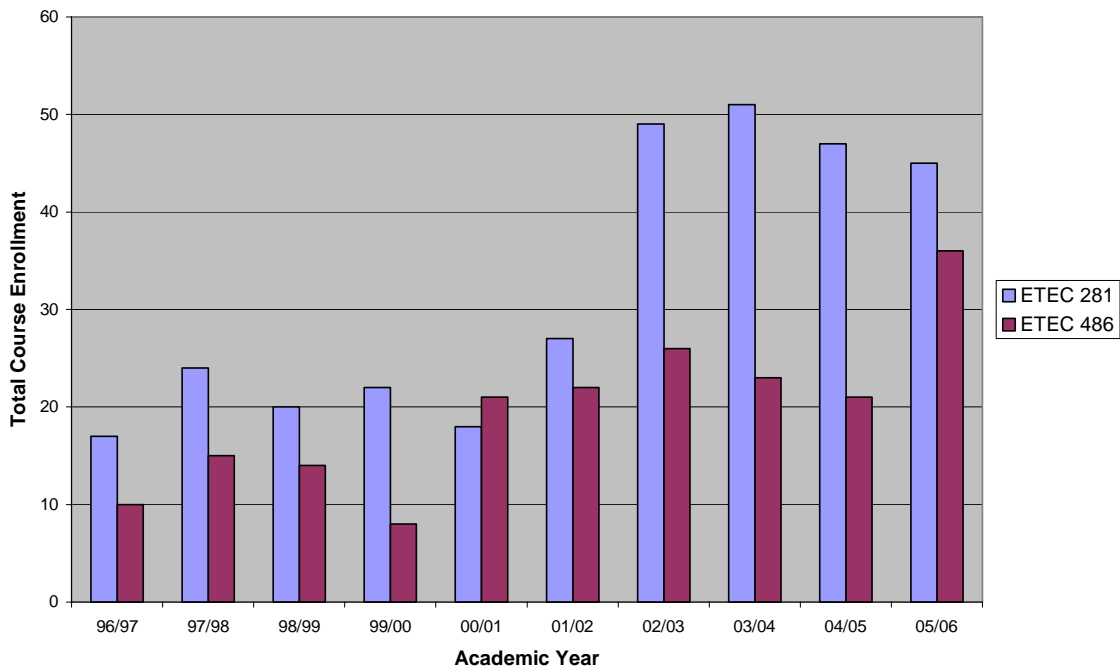


Figure 2: Vehicle Design Enrollment by Year



Students in the IT – Vehicle Design program have recently begun to notice that employer demand for PET graduates is significantly greater than for IT – Vehicle Design graduates. Apparently reasoning that combining the two allows them to study vehicle design and

composites while at the same time having the additional credentials in the job market offered by the ABET accredited ET degree, students have begun to show interest in double majoring in IT–Vehicle Design and PET. To date one student has successfully completed such a double major, and two additional students declared a double major earlier this year before the department stopped allowing students to declare the second major out of concerns about the resource impact of significant numbers of individual students completing both majors. Additional students have inquired about double majoring. Based upon this trend, we believe that there will be a significant student demand for an option within the PET degree that emphasizes composites and includes substantial elements of vehicle design. It will allow students to be associated with Western’s well-known Vehicle Design program, while giving them the qualifications needed to satisfy a broader range of employers. Furthermore, this approach offers the additional benefit of reducing the resources required relative to allowing students to double major.

Demonstration of Employer Demand

Upon completion of the proposed PET-VD program a student will receive an ABET accredited BS degree in Plastics Engineering Technology. In the 2004/05 academic year the PET program graduated 9 students. Of those, 7 were employed in engineering titled positions, 1 was in a related technical position (CNC programmer), and the status of one is unknown. Of the eight whose status was known, seven were employed in Washington State. Key employing industries of these graduates were aerospace and medical/analytical products, which together account for 6 of the 8 reporting graduates.

The demand for graduates of the program is continuing in the 2005/06 academic year. This year the program will graduate 11 students with a BS in Plastics Engineering Technology. By comparison, over the one year period from May 1, 2005 through May 1, 2006 the PET program faculty have received 39 job announcements from 27 different companies targeted specifically toward PET majors. Because of the limited number of graduates from the PET program, many of these positions have gone unfilled.

Identification of Program Goals, Outcomes, and Assessment Plan:

The primary goal of this proposed project is to increase the number of graduates from Plastics Engineering Technology with a focus in Vehicle Design and Composites. By the end of the 2006-2007 academic year, the number of majors will be increased by ten FTE students. This increase in students will improve the ability for employers to hire manufacturing engineers for entry-level positions in the areas of: processing, materials, product design, molds/tooling, quality, sales, and technical management. An additional goal of the project is to place 100% of these students in positions upon graduation. This goal will be achieved by continuing to have high interaction with industry employers.

To ensure that graduates are well prepared for these careers, the following curricular objectives have been developed.

Objective 1	Graduates will have a firm base of mathematics, physics, chemistry, and materials science for the development of a broad range of plastics and composites manufacturing components.
Objective 2	Graduates will have extensive knowledge of current polymeric and composite materials and processing methods and are able to adapt to emerging technologies.
Objective 3	Graduates will have breadth to be capable of understanding areas of manufacturing and business outside their primary discipline.
Objective 4	Graduates will demonstrate strong communication skills, be able to work as an individual or as a member of a team, and show the ability to work in an efficient, timely manner to meet quality and economic goals.
Objective 5	Graduates will have a well rounded education in order to understand their professional and ethical responsibility and the impact of engineering solutions in a global and societal context.

The following metrics will be used to assess and report the graduation rates of students, the employment experience of recent program graduates, and the project results:

- A survey will be sent to the primary supervisor of new graduates one year after commencement of employment.
- A survey will be sent to graduates one year after graduation.
- Employment rates of students are tracked by WWU's Career Services Center and the results are published annually in the "Employment Status Report".
- Graduation rates of students are tracked by the number of students enrolled as juniors compared to number of students completing the degree.
- Annually, the Industrial Advisory Committee of the Plastics Engineering Technology program convenes to review the curriculum and provide feedback. This committee consists of representatives from both the plastics and composites industries. These representatives vary from entry-level engineers to high-level managers and engineers.

Proposed Budget

Please see the HECB-provided budget worksheet attached for the details of the proposed budget for FY 2006-07. In addition to the salaries and benefits associated with the two new full-time positions, including one faculty position and one technician, funds will be required for equipment, travel, services and supplies. As indicated in the worksheet, recurring funding will be necessary to support these program enhancements beyond FY 2006-07. If awarded these high-demand state grant funds for these new enrollments, Western will request continuation of the recurring funding components within our 2007-

2009 carry-forward operating budget to be submitted on September 1, 2006, to the Governor, Legislature and the HECB.

The one FTE faculty will be used to offer additional sections of critical courses in Vehicle Design, Plastics, and courses which support these programs such as CNC Machining.

The one FTE technician will be used to provide additional support to the Plastics and Vehicle Design labs to accommodate the additional students. In addition, technical support will allow faculty to offer more lab sections of critical courses to improve throughput most efficiently.

Plan to Continue Program Beyond 2006-07 Fiscal Year

Western Washington University is committed to providing a modern education in Engineering Technology to qualified students. The Engineering Technology Department is recognized as having an outstanding faculty that provides an excellent education in Engineering Technology. The University will continue this program to enhance the opportunities available through the Engineering Technology Department. Specifically, the salary of the faculty member, the laboratory technician, will continue to be provided as will the associated increase in operating funds.

Attachment: Budget Plan for Expansion Proposal

WESTERN WASHINGTON UNIVERSITY
High Demand Proposal - Amended 5-12-06

Plastics Engineering Technology
2006-07 HIGH DEMAND ENROLLMENTS

New Students Served by this proposal

Student Headcount (Optional)	Student FTE (Required)
	10.00

	2006-07 Staff Headcount Optional	2006-07 Staff FTE Required	2006-07 One Time Costs All Sources	2006-07 Recurring Costs All Sources	2006-07 Total Costs All Sources
Faculty Salaries (including benefits)					
Faculty including benefits		1.0	0	70,000	70,000
Adjuncts including benefits					
TA Salaries including benefits					
Staff Salaries (including benefits)					
Exempt					
Classified		1.0	0	42,000	42,000
Hourly			0	0	0
Personal Service Contracts - describe					
Goods and Services			0	3,000	3,000
Travel					
Equipment			0	5,000	5,000
Other - describe if over \$5000			0	1,000	1,000
Total Instruction	0.0	2.0	0	121,000	121,000
Recurring Indirect Costs:					
Primary Support				\$ 4,047	4,047
Libraries				\$ 4,563	4,563
Student Support Services				\$ 6,974	6,974
Institutional Support				\$ 5,166	5,166
Plant Operation and Maintenance				\$ 6,113	6,113
One-time Indirect Costs (Grant Admin)			0		0
Total Expenditures (Uses)	0.0	2.0	\$ -	\$ 147,863	\$ 147,863
Total Cost Per Student FTE					14,786
Less: Annual Tuition Per Student					3,235
Requested State Funding Per Student FTE					11,551

Notes:

- This amended budget was updated 6-16-06 to add notes 1-3.
- This amended budget reflects the following adjustments to the budget originally submitted with the proposal:

Adjustment description:

5,000 Increase in recurring faculty salaries (including benefits)
 (1,000) Decrease in recurring hourly staff salaries (including benefits)
 (2,000) Decrease in recurring goods and services cost
 (5,000) Decrease in recurring equipment cost
 (1,781) Decrease in recurring primary support cost
 (2,009) Decrease in recurring libraries cost
 (3,070) Decrease in recurring student support services cost
 (2,274) Decrease in recurring institutional support cost
 (2,691) Decrease in recurring plant operation and maintenance cost
 (12,000) Decrease in one time equipment cost
 (10,421) Decrease in one time grant administration cost
 (37,246) Decrease in total expenditures (total costs column)
 relative to budget originally submitted

- Annual Tuition Per Student is computed as follows:

3,740 Operating fee (2005-06 tuition of \$3,528 x 1.06% = \$3,740)
 (374) 10% tuition waivers
 (131) 3.5% diverted to student loan fund
 3,235 Net operating fee